BAYOU BOEUF TMDL FOR FECAL COLIFORM

SUBSEGMENT 060208

US EPA Region 6

With cooperation from the
Louisiana Department of Environmental Quality
Office of Environmental Assessment
Environmental Technology Division

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources discharging to the waterbody. A TMDL has been developed for fecal coliform bacteria for Bayou Boeuf.

Bayou Boeuf flows in a generally southerly direction, to a confluence with Bayou Cocodrie, forming the headwaters of Bayou Courtableau. Bayou Boeuf segment 060208 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for primary contact recreation (swimming) and was ranked as high priority for TMDL development. Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

The standard for secondary contact recreation reads similarly:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

Five years (January, 1994 – December 1998) of monthly LDEQ monitoring data on Bayou Boeuf (WQ site 104) were assessed to determine if the primary and secondary contact recreation uses were being maintained. Analysis of the data for the November – April season shows that the secondary contact recreation use is being maintained (see Appendix A). Analysis of the data for the May – October season shows that the primary contact recreation use is not protected (see Appendix A). Therefore, a TMDL will be developed to protect the May – October season.

For the purpose of calculating current loading on Bayou Boeuf the average fecal coliform concentration at LDEQ WQ site 104 for the May – October season was calculated using monthly LDEQ monitoring data. In Bayou Boeuf, the monthly fecal coliform counts for this season ranged from 50 cfu/100mL to 5,000 cfu/100mL over the 5-year period (January, 1994-December, 1998).

For the purpose of TMDL development, the criteria of 200/100mL for the May – October season was applied. A TMDL fecal coliform loading curve for this period (May 1 – October 31) has been generated as Figure 1. This TMDL loading curve was developed using Equation 1, substituting the criteria, 200 cfu/100 ml, for FC concentrations and varying flows. The attempt

here is to show that while a TMDL may be expressed as a single point it can also be thought of as a continuum of points representing the criterion value and various flow values. A 79% reduction in fecal coliform loading during the May – October season will be needed to protect the primary contact recreation use.

1. Introduction

Bayou Boeuf segment 060208 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for primary contact recreation (swimming). Segment 060208 was ranked as high priority (ranking of 1) on the 1998 List. A TMDL for fecal coliform bacteria was developed in accordance with the requirements of Section 303 of the federal Clean Water Act. The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant; the TMDL also establishes the load reduction that is necessary to meet the standard in a waterbody. The TMDL consists of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The wasteload allocation is the load allocated to point sources of the pollutant of concern, and the load allocation is the load allocated to nonpoint sources. The margin of safety is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions, data inadequacies, and growth.

2. Study Area Description

2.1 Bayou Boeuf, Segment 060208

Bayou Boeuf is located within basin/segment 0602 in south central Louisisna. Bayou Boeuf flows in a generally southerly direction, to a confluence with Bayou Cocodrie, forming the headwaters of Bayou Courtableau. Most of the area of the Bayou Boeuf watershed lies within the natural flood plain of the Red River. The Red River is now leveed, eliminating the potential for a natural flow of water from the River into any of the streams in Segment 0602.

Land use is predominately forest and agriculture with the Alexandria urban area located to the north. Suburban communities have developed in the agricultural lands immediately south and west of Alexandria. The major land uses are listed in Table 1 (LDEQ, 1993).

Table 1. Land Use (acres) in Segment 0602: Vermilion-Teche Basin

SEGMENT	AGRICULTURE	URBAN	WETLAND	FOREST
0602	676,490 (64.1%)	46,942 (4.5%)	73,230 (6.9%)	245,115 (23.2%)

2.2 Water Quality Standards

The designated uses for Bayou Boeuf include both primary contact recreation and secondary contact recreation. Fecal coliform bacteria are the indicator used for the water quality criteria and for assessment of use support. Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1

through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

The standard for secondary contact recreation reads similarly:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

2.3 Identification of Sources

The sources identified in the *1998 Louisiana Water Quality Inventory* as affecting the water quality of Bayou Boeuf are designated as "Other" (natural sources) (LDEQ, 1998).

2.3.1 Point Sources

There are 30 permitted facilities (with known flow information) discharging sanitary wastewater into Bayou Boeuf and its tributaries. The combined flow of all these discharges is 974,370 gallons per day (See Appendix B).

2.3.2 Nonpoint Sources

The predominant land uses along Bayou Boeuf are agriculture and forestry. It is presently unknown to what relative extent these sources contribute to fecal coliform loads.

3. TMDL Load Calculations

3.1 Current Load Evaluation

Fecal coliform loads have been calculated using the instream bacterial counts and the flow of the stream. The following equation can be used to calculate fecal coliform loads.

Equation 1. C x 1000mL/ L x 1 L/0.264 gallons x Q in gallons/day = cfu/day

Where: C = colony forming units/100mL
Q = stream flow in gallons/day

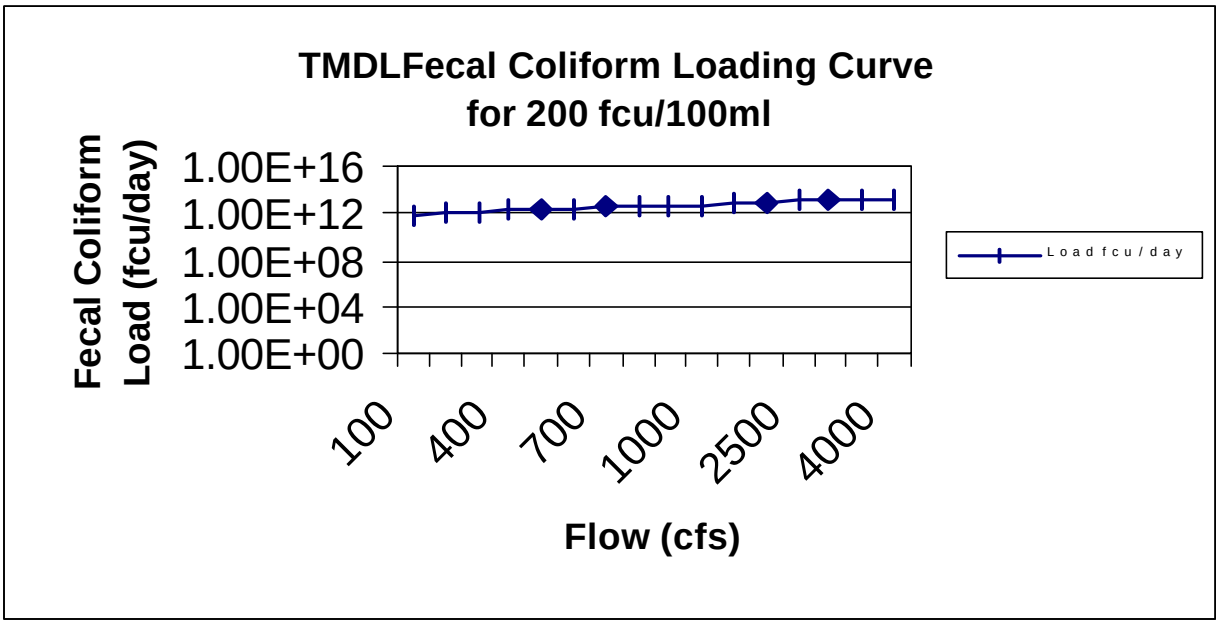
A traditional expression of the FC loading may be developed by setting one critical or representative flow and concentration, and calculating the fecal coliform load using Equation 1. The difficulty with this approach is in the determination of the appropriate flow or concentration value to use. For the purpose of calculating current loading on the this waterbody the average fecal coliform concentration for the May-October season was calculated using monthly LDEQ monitoring data on Bayou Boeuf (WQ site 104). WQ site 104 was used because of its multiple years of fecal coliform data. In Bayou Boeuf, the monthly fecal coliform counts for this season ranged from 50 cfu/100mL to 5,000 cfu/100mL over a 5-year period (January, 1994-December, 1998). The average fecal coliform count for the May – October season is 937 cfu/100ml (see

Appendix A). In addition, the average flow for Bayou Boeuf, for the May – October season is 165 ft^3/sec (see Appendix C). Using these values and Equation 1 it is estimated that the current loading for the May – October season is 3.78E12 cfu/day.

3.2 TMDL

Point sources usually have a defined critical receiving stream low flow such as the 7Q10 at which the criterion must be met. For nonpoint sources it is recognized that there may be no single critical flow condition. To address this condition, a TMDL fecal coliform loading curve for the recreational period (May 1 – October 31) has been generated as Figure 1. This TMDL loading curve was developed using Equation 1, substituting the criteria, 200 cfu/100 ml, for FC concentrations and varying flows. The attempt here is to show that while a TMDL may be expressed as a single point it can also be thought of as a continuum of points representing the criterion value and various flow values. This curve is not stream dependent but is dependent upon the designated stream criterion. Therefore, it may be applied to any stream with a like FC criterion. This curve represents the TMDL loading allocation for FC.

Figure 1. TMDL Fecal Coliform Loading Curve for the May – October season.



Utilizing Figure 1 one can select a stream flow and can quickly determine the FC loading value. The line formed by this series of points may be thought of as a boundary. At any given flow the loading may be below the line, within the boundary, or above the line. FC load values falling above the line represent disproportionately high values relative to the standard. FC load values falling below the line represent low loads relative to the standard. To develop load reductions one simply needs to determine the appropriate flow value (x-axis) and see where it intersects the load allocation line.

The load reduction needed to meet the water quality standard for primary contact recreation in Bayou Boeuf at 165 cfs is 2.97 E12 cfu/day (79% reduction)[1]. This was obtained by calculating the allowable TMDL at 165 cfs for the 200 cfu/100ml criterion (8.06 E11 cfu/day) and subtracting this load from the observed load (3.78 E12 cfu/day, see Appendix A).

Current Load - TMDL = Load Reduction

3.78 E12 cfu/day – 8.06 E11 cfu/day = 2.97 E12 cfu/day

3.3 Wasteload Allocation (WLA)

The Louisiana Water Quality Regulations require permitted point source discharges of treated sanitary wastewater to maintain a fecal coliform count of 200cfu/100ml in their effluent, i.e., they must meet the standard at end-of-pipe. Therefore, there will be no change in the permit requirements based upon a wasteload allocation resulting from this TMDL.

Equation 1 can be used to calculate the total point source load (wasteload allocation) utilizing a fecal coliform count of 200cfu/100ml and the total volume of all the wastewater dischargers (974,370 gallons/day).

200 cfu/100mL * 1000mL/L * 1 L/0.264 gallons * Q gallons/day = WLA

Where Q = Total volume of sanitary wastewater discharges into Bayou Boeuf

WLA for all dischargers = 7.38 E9 cfu/day

3.4 Load Allocation (LA)

The load allocation for each season for a given flow can be calculated using Equation 1 and the following relationship:

(TMDL@ given flow and criterion) - (WLA)= LA

LA for May – October season at an instream flow of 165 cfs = 7.98 E11 cfu/day

8.06 E11 cfu/day (TMDL@ 165 cfs) – 7.38 E9 cfu/day (WLA) = 7.98 E11 cfu/day

3.5 Seasonal Variability

Louisiana has established a seasonal water quality standard for bacteria based upon definition of a summer swimming season and winter secondary contact only. In development of this TMDL data for all seasons were evaluated and it was determined that a TMDL for the May - October season was needed to protect the primary contact recreation use.

[1] Expression of the load reduction percentage was adjusted since publication of the draft TMDL based on public comment; see EPA's response-to-comments at http://www.epa.gov/earth1r6/6wq/tmdl.htm for further explanation.

3.6 Margin of Safety (MOS)

The Clean Water Act requires that TMDLs take into consideration a margin of safety. EPA guidance allows for the use of implicit or explicit expressions of the margin of safety or both. When conservative assumptions are used in the development of the TMDL or conservative factors are used in the calculations, the margin of safety is implicit. When a percentage of the load is factored into the TMDL calculation as a margin of safety, the margin of safety is explicit. In this TMDL for fecal coliform, conservative assumptions have been used and therefore, the margin of safety is implicit. These conservative assumptions are:

- Using average seasonal flows to calculate current loading to obtain load reduction.
- Treating fecal coliform bacteria as a conservative pollutant, that is, a pollutant that does not degrade in the environment (bacteria do die off in the environment)
- Using the more conservative 200 cfu/100mL standard rather than 400 cfu/100mL for the summer primary contact recreational season.
- Using the design flow of the point source dischargers rather than actual average flow rates, which are typically much lower

4. Other Relevant Information

Utilizing funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act, the LDEQ has established a program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface-water monitoring program are to determine the quality of the state's surface waters, to develop a long-term database for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface-water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been established by the time the first priority basins will be monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the first five-year cycle is shown below. The Vermilion-Teche River Basin will be sampled again in 2003.

1998 – Mermentau and Vermilion-Teche River Basins
1999 - Calcasieu and Ouachita River Basins
2000 – Barataria and Terrebonne Basins
2001 – Lake Pontchartrain Basin and Pearl River Basin
2002 – Red and Sabine River Basins

(Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance-sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

5. Public Participation

When EPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999, Court Order, EPA prepared this TMDL. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. EPA has transmitted this revised TMDL to the Court, and to the Louisiana Department of Environmental Quality (LDEQ) for incorporation into LDEQ's current water quality management plan.

REFERENCES

LDEQ, 1993. *State of Louisiana Water Quality Management Plan, Volume 6, Part A: Nonpoint Source Pollution Assessment Report*. Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge, La.

LDEQ, 1998. *State of Louisiana Water Quality Management Plan, Volume 5, Part B: Water Quality Inventory*. Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge, La.

APPENDIX A Fecal Coliform data and loading calculations for each season.

Bayou Boeuf WQ site 104

November - April		FECAL COLIFORM		May - October		FECAL COLIFORM
DATE	TIME	MPN/100 ML		DATE	TIME	MPN/100 ML
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04/14/1998	936	230		10/14/1997	857	300
02/10/1998	1000	300		08/12/1997	857	1300
04/15/1997	840	130		10/15/1996	905	300
02/18/1997	850	300		08/13/1996	840	800
12/10/1996	840	80		06/11/1996	905	110
12/09/1997	912	800		06/10/1997	920	5000
04/09/1996	1100	130		10/10/1995	858	50
02/13/1996	905	140		08/15/1995	910	1400
12/12/1995	900	500		06/13/1995	905	300
04/04/1995	855	50		10/11/1994	850	80
02/14/1995	900	900		08/09/1994	910	500
12/13/1994	905	110		06/14/1994	915	1100
04/12/1994	845	500			Average =	937
02/08/1994	855	300		% Exceedance of 400/100ml =		50%
	Average =	319				
% Exceedance of 2000/100ml =		0%				
		Flow	Fecal	Flow	Load	
		cfs	Count (fcu)	gal/day	fcu/day	
Current May - Oct Load		165	937	106451613	3.78E+12	
Allowable May - Oct Load		165	200	106451613	8.06E+11	
% Load Reduction May - Oct		369				

APPENDIX B Dischargers in subsegment.

Dischargers to Bayou Boeuf			
Facility	Permit #	Receiving Water	Discharge Flow
			gallons/day
KOA Campground		Bayou Boeuf	11,000
Tunk's Cypress Inn		Bayou Boeuf	11,000
Oak Shawdow Subdivision	LA0062391	Bayou Boeuf	5,000
Woodlands Subdivision	LA0069639	Bayou Boeuf	17,000
Cloverdale Subdivision	LA0039021	Bayou Boeuf	140,000
Gerard Glen Apartments		Bayou Boeuf	6,000
Gary Glen Apartments		Bayou Boeuf	7,000
Lynnwood Acres Subdivision	LA0072559	Bayou Boeuf	16,000
Timberlake VI Subdivision		Bayou Boeuf	19,000
Timberlake Subdivision	LA0056654	Bayou Boeuf	60,000
Grundy Cooper Subdivision	LA0039012	Bayou Boeuf	135,000
Lebanon Subdivision	LA0038997	Bayou Boeuf	36,000
Twin Bridges Mobile Home Park	LA0069698	Turkey Bayou to Bayou Boeuf	24,000
Bayou Oaks Estates	LA0071404	Bayou Boeuf	24,000
Penny Acres Subdivision	LA0038989	Bayou Boeuf	38,000
Westgate Village Subdivision		Bayou Boeuf	11,000
Brookwood Subdivision		Bayou Boeuf	66,000
Spring Creek Apartments		Bayou Boeuf	4,000
Methodist Conference Center		Bayou Boeuf	87,000
Willow Creek Apartments		Bayou Boeuf	0
Deerfield Subdivision	LA0072541	Bayou Boeuf	0
Valentinel Rec. Area	LA0040983	Bayou Boeuf	21,000
Town of Cheneyville	LA0059927	Bayou Boeuf	15,000
White Development Company	LA0083666	Bayou Boeuf	0
Springdale Westgate Sewer Dist	LA0083763	Bayou Boeuf	0
Diamond "B" Construction Co.	LA0086355	Bayou Boeuf	300
Waste Management Control	LA0095842	Bayou Boeuf	250
Martco Partnership	LA0062651	Bayou Wauksha	820
Wodlands	LA0081035	Bayou Boeuf	200,000
McKeithon Mobile Home Park	LA0071544	Bayou Boeuf	20,000
		total	974,370

APPENDIX C Flow calculation methodology.

January 27, 2000

DETERMINATIONS OF AVERAGE STREAMFLOW FOR SELECTED LADEQ WATER QUALITY STATIONS IN LOUISIANA.

Note: *The* "average streamflow" is defined to be the annual average streamflow.

Bayou Des Cannes northeast of Jennings (DEQ # 0308 and 0647) - Based on the runoff for the USGS station on Bayou Des Cannes near Eunice, 2.11 CFS per square mile, and a drainage area for the 308 site of 368.69 square miles, the average streamflow is estimated to be 778 CFS. . The May - October average flow is estimated to be about 73% of the annual average flow; the Novcmber - April average flow is estimated to be about 127 % of the annual average flow.

Bayou Nezpique at La. 104 north of Basile (DEQ 005) -- Based on the runoff for the USGS station on Bayou Nezpique near Basile, 1.89 CFS per square mile, and a drainage area for the 005 site of 327.62 square miles, the average streamflow is estimated to be 619 CFS. . The May - October average flow is estimated to be about 47% of the annual average flow**;** the November - April average flow is estimated to be about 153 % of the annual average flow.

Bayou Nezpique at La. 97 near Jennings (DEQ 309) -- Based on the runoff for the USGS station on Bayou Nezpique near Basile, 1.89 CPS per square mile, and a drainage area for the 309 site of 580 square miles, the average streamflow is estimated to be 1,096 CFS. The May - October average flow is estimated to be about 47**%** of the annual average flow-, the November - April average flow is estimated to be about 153 % of the annual average flow.

Bayou Nezpique at boat landing near Jennings (DEQ 651) - Based on the runoff for the USGS station on Bayou Nezpique near Basile, 1.89 CFS per square mile, and a drainage area for the 651 site of 585 square miles, the average streamflow is estimated to be 1, 106 CFS. The May - October average flow is estimated to be about 47**%** of the annual average flow; the November - April average flow is estimated to be about 153 % of the annual average flow.

Bayou Plaquemine Brule at Refinery (DEQ 650) - Based on the runoff for the USGS station on Bayou Des Cannes near Eunice (best available estimator), 2.11 CFS per square mile, and a drainage area for the 650 site of 331.87 square miles, the average streamflow is estimated to be 700 CFS. The May - October average flow is estimated to be about 73% of the annual average flow; the November - April average flow is estimated to be about 127 % of the annual average flow.

DETERMINATIONS OF AVERAGE STREAMFLOW FOR SELECTED LADEQ WATER QUALITY STATIONS IN LOUISIANA PAGE 2.

Bayou Boeuf at mouth (DEQ 668) - Based an the runoff for the USGS station an Bayou Courtableau near Washington, 1.56 CPS per square mile, and a drainage area for the 668 site of 234.33 square miles, the average streamflow is estimated to be 312 CFS. The May - October average flow is estimated to be about 53% of the annual average flow; the November - April average flow is estimated to be about 147% of the annual average flow.

Bayou Teche at Breaux Bridge (DEQ 03 1) -- Based on the adjusted runoff for the USGS station on Bayou Teche at Arnaudville and a subtraction of the estimated average flow for Bayou Fusilier, the estimated average streamflow is 760 CFS. The May - October average flow is estimated to be about 76% of the annual average flow; the November - April average flow is estimated to be about 124 % of the annual average flow.

Bayou Teche at Adeline (DEQ 030) – With the assumption that the average streamflow for the USGS station on Bayou Teche at Keystone Lock and Dam is the same as the average streamflow at Adeline, the estimated average streamflow for Site DEQ 030 is 491 CFS. The May-October average flow is estimated to be about 78% of the annual average flow; the November-April average flow is estimated to be about 122% of the annual average flow.

Vermilion River at Perry (DEQ 001) – Based on DEQ determinations for Vermilion River at Surrey Street in Lafayette using USGS data for the period 94-97, the average flow for the Vermilion River at Perry is about 750 CFS. For May-October, the average flow is estimated to be about 600 CFS; for November- April, the average